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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/058,430	01/30/2002	Keiji Kanao	2635-91	4297

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EXAMINER
DONG, DALEI

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 07/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/058,430	KANAO ET AL.	
	Examiner	Art Unit	
	Dalei Dong	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 July 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) *9* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *10/058,430* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, the phrase "substantially" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000.

Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims 1 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,304,022 to Matsutani.

Regarding to claim 1, Matsutani discloses in Figure 2A, "a spark plug 100, which serves as an embodiment of the present invention, includes a cylindrical metallic shell 1 ***(tubular housing)***, an insulator 2 ***(electrical insulation)***, a center electrode 3, and a ground electrode 4 ***(earth electrode)***. The insulator 2 is inserted into the metallic shell 1 such that a tip portion 21 of the insulator 2 projects from the metallic shell 1. The center electrode 3 is fittingly provided in the insulator 2 such that a spark discharge portion 31 formed at a tip end of the center electrode 3 projects from the insulator 2. One end of the ground electrode 4 is connected to the metallic shell 1 by welding or a like method, and the other end of the ground electrode 4 is bent toward the center electrode 3 such that the side surface of the ground electrode 4 faces the tip of the center electrode 3. A spark discharge portion 32 ***(chip arranged at an end surface of the earth electrode)*** is formed on the ground electrode 4 so as to face the spark discharge portion 31. The spark discharge portions 31 and 32 define a spark discharge gap g therebetween" (column 8, line 40-56).

Matsutani also discloses in Figure 2B, "a body portion 3a of the center electrode 3 and a body portion 4a of the ground electrode 4 are formed from an Ni alloy or a like alloy. In contrast, the spark discharge portion 31 and the spark discharge portion 32

facing the spark discharge portion 31 are formed from a noble alloy containing a main component element selected from among Ir, Pt, and Rh, and at least one additional component element selected from among Rh, Pt, Pd, Re, Ru, Nb, Os, and W, such that the additional component element(s) differ from the main component element. The noble alloy has a structure shown schematically in FIG. 3. Flat main component phase regions and flat additional component phase regions are layered in the direction of voltage application at the spark discharge surface 31 (in the direction parallel to the axis O of the center electrode 3 in FIG. 1); each of the main component phase regions is mainly formed of the aforementioned main component element; and each of the additional component phase regions contains the additional component element in an amount greater than that in the main component phase regions, and the main component element in an amount that is 97% or less that in the main component phase regions" (column 9, line 3-24).

Matsutani further discloses in figure 2B, "the body 3a of the center electrode 3 has a tip end portion whose diameter decreases toward the flat tip end surface thereof. The disk-shaped chip 150 (FIG. 6B) is placed on the tip end surface of the center electrode 3. Subsequently, a weld zone W ***(fused junction layer)*** is formed along the boundary between the chip and the tip end portion through laser welding, electron beam welding, resistance welding, or a like welding method, thereby fixedly attaching the chip onto the tip end portion and forming the spark discharge portion 31. Likewise, the chip 150 (FIG. 6B) is placed on the ground electrode 4 in a position corresponding to the spark discharge portion 31; thereafter, the weld zone W is formed along the boundary between the chip and the ground electrode 4 so as to attach the chip fixedly onto the

ground electrode 4, to thereby form the spark discharge portion 32" (column 10, line 46-60).

Matsutani further yet discloses "Predetermined amounts of Ir, Rh, and Pt were mixed and melted, to thereby produce an alloy having a composition of Ir(90 wt. %)--Rh(5 wt. %)--Pt(5 wt. %). The alloy was hot rolled into a plate having a thickness of 0.6 mm through hot working at 700.degree. C. Next, the plate was subjected to hot punching (at 700.degree. C. or more), to thereby obtain disk-shaped chips having a diameter of 0.8 mm ***(cross sectional area of the chip at the chip tip is not less than 0.12mm^2 and not more than 1.15mm^2)*** and a thickness of 0.6 mm" (column 16, line 28-35).

Matsutani finally discloses "the chips were used for forming the spark discharge portions 31 and 32 of the spark plug 102 shown in FIG. 18 according to the procedure shown in FIG. 20 (spark discharge gap g: 1.1 mm, a spark plug of a Reference Example). Both the center electrode 3 and the ground electrode 4 were formed from Ni alloy (Inconel 600). The cross section of the ground electrode 4 had a square shape having a thickness of 1.5 mm and a width of 2.8 mm. In contrast, the projection 4f had a columnar shape having an outer diameter of 1.1 mm and a height of 0.3 mm. The noble metal chip 32' was fixed to the projection 4f through laser welding. H1, H2, and H3 in FIG. 19 were 0.25 mm, 0.9 mm ***(a length from the end surface to the top surface of the tip is not less than 0.3 mm and not more than 1.5 mm)***, and 0.6 mm, respectively. For comparison, another spark plug having the structure shown in FIGS. 16A and 16B was prepared (a spark plug of a Comparative Example). In this spark plug, the depth of the depression 4d was 0.5 mm, the height from the surface 4c to the top surface 4e of the spark discharge

portion 32 was 0.1 mm, and the width W1 of the weld zone W was 0.5 mm" (column 16, line 36-52).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 2 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,304,022 to Matsutani in view of U.S. Patent No. 6,078,129 to Gotou.

Regarding to claim 2, Matsutani discloses the claimed invention except for the radius of the fused junction of $D/4 \leq R \leq 3D/4$. Gotou discloses in Figures 6-8, "The shape of each molten bond 11 which is formed with the laser beam having energy of 5.0 J, 7.5 J and 10.0 J, respectively, is observed and shown in FIGS. 6, 7 and 8. The molten bond formed with 5.0 J laser energy shown in FIG. 6 is relatively small, but Rh contained in the molten bond is higher than that of a comparative sample mentioned later (in which noble metal chip is made of pure Ir containing no Rh). The molten bond formed with 7.5 J laser energy shown in FIG. 7 is large, and Rh and Ni are well melted into the molten bond. The molten bond formed with 10.0 laser energy shown in FIG. 8 is sufficiently large, and no void is observed in the molten bond though depression 111 is formed around the periphery of the molten bond" (column 4, line 38-50).

Matsutani in view of Gotou discloses the claimed invention except for radius of the fused junction of $D/4 \leq R \leq 3D/4$. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilize different energy laser beam to form a fused junction layer with different radius according to the design specification and requirements, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

Regarding to claim 7, Gotou teaches the application of a laser beam welding where the laser beam consist of different energy levels. Different energy levels from the laser beam are capable of melting (or welding) different amount of materials from the chip and the electrode. Therefore, Matsutani in view of Gotou discloses the claimed invention except for the fused junction layer includes the component of the chip not less than 35% by weight and not more than 80% by weight. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilize different energy laser beam to form a fused junction layer with different components forming the fused junction layer according to the design specification and requirements, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

7. Claims 3 and 4 rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,304,022 to Matsutani.

Regarding to claims 3 and 4, Matsutani discloses "as the additional component, there may be used at least one element selected from among Rh, Pt, Ir, Pd, Re, Ru, Nb, Os, and W, so long as the element is different from the main component element. For example, when a spark discharge portion is formed from an alloy which contains Ir as a main component and to which at least one element selected from among Rh, Pt, Pd, Re, Ru, Nb, Os, and W is added, the main component element is Ir, and the additional component element is at least one element selected from among Rh, Pt, Pd, Re, Ru, Nb, Os, and W. More specifically, when the alloy forming the spark discharge is an Ir--Rh binary alloy which contains Ir as a main component and Rh as an additional component, the main component element is Ir and the additional component element is Rh . Likewise, when the alloy forming the spark discharge is an Ir--Rh--Pt ternary alloy which contains Ir as a main component and Rh and Pt as additional components, the main component element is Ir and the additional component elements are Rh and Pt" (column 4, line 62-67 to column 5, line 1-12).

It is old and well known in the art to add different elements with predetermined percentage of composition to the chip in order to increase its efficiency while maintaining longer lasting lifetime, further applicant has not established that the percentage of composition of different element of the chip is critical to the invention and hence, the percentage of composition of different elements can be determined by routine experimentation by one having ordinary skill in the art.

8. Claims 5, 6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,304,022 to Matsutani in view of U.S. Patent No. 4,786,267 to Toya.

Regarding to claims 5, 6 and 8, Matsutani discloses a spark plug comprising: a tubular housing; a central electrode supported by said tubular housing in said tubular housing with electrical insulation therebetween; an earth electrode extending from one end of said tubular housing; a chip, arranged at an end surface of said earth electrode to face said central electrode, for providing a spark gap between said central electrode and said chip, said chip including a novel metal; and a fused junction layer between said earth electrode and said chip including components of said chip and said earth electrode to fix said chip to said earth electrode, wherein a cross-sectional area of said chip at a tip thereof on the opposite side of said fused junction layer is not less than 0.12 mm.sup.2 and not more than 1.15 mm.sup.2, and a length from said end surface to a top surface of said tip is not less than 0.3 mm.sup.2 and not more than 1.5 mm.sup.2, and wherein said fused junction layer has substantially a conical outer surface continuously connecting a peripheral outer surface of said chip to said end surface of said earth electrode with a radius on a sectional plane along an axis of said chip.

However, Matsutani does not disclose a chip mainly includes Pt and further includes at least one of Ir of lower than or equal to 50% by weight, Ni of lower than or equal to 40% by weight, Rh of lower than or equal to 50% by weight, W of lower than or equal to 30% by weight, Pd of lower than or equal to 40% by weight, Ru of lower than or equal to 30% by weight, and Os of lower than or equal to 20% by weight.

Toya teaches "thin noble metal layers 10,11 are formed on or in the end surface of the center electrode (1) and a discharge-related area of the inner end surface of the ground electrode 7 by bonding noble metal powder 9 [see, FIG. 3(c) for example] to the end surface and discharge-related area in accordance with ultrasonic bonding. As exemplary material useful as the noble metal powder 9 in the formation of the thin noble metal layers 10,11, may be mentioned pure noble metals such as Pt, Pd, Ir, Ru, Rh and Au; alloys of these noble metals (may hereinafter be called "noble metal alloys" for the sake of clarification) such as Pt-Pd, Pt-Ir, Pt-Ru, Pt-Rh, Pt-Ir-Pd, Pt-Ir-Ru, Pt-Ir-Pd-Ru and Au-Pd alloys; alloyed noble metal materials obtained by adding Ni, WSi or W to the above noble metals or noble metal alloys, including Pt alloys such as Pt-Ni, Pt-W, Pt -WSi and Pt-Ir-Ni, Pd alloys such as Pd-Ni, Pd-W, Pd -WSi and Pd-Pt-Ni, Ir alloys such as Ir-Ni, Ir-W, Ir -WSi and Ir-Pd-Ni, Ru alloys such as Ru-Ni, Ru-W, Ru -WSi and Ru-Pt-Ni, Rh alloys such as Rh-Ni, Rh -WSi and Rh-Pt-Ni and Au alloys such as Au-Ni, Au-W and Au-WSi; and mixtures consisting each of at least two of the above noble metals, noble metal alloys and alloyed noble metal materials. Besides, all other Pt -base alloys may also be used in the practice of this invention" (column 4, line 30-54).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilize the electrode of Toya for the spark plug of Matsutani in order to free from wasting of noble metals so as to permit a significant reduction to the manufacturing cost and is provided with a noble metal layer of good properties at a discharge-related surface area of at least one of center and ground electrodes so as to improve its durability.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following prior art are cited to further show the state of the art of composition of a spark plug.

U.S. Patent No. 6,121,719 to Matsutani.

U.S. Patent No. 6,166,479 to Matsutani.

U.S. Patent No. 6,533,628 to Matsutani.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dalei Dong whose telephone number is (703)308-2870. The examiner can normally be reached on 8 A.M. to 5 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sandra O'Shea can be reached on (703)305-4939. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9318 for regular communications and (703)872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

D.D.
July 18, 2003

Sandra O'Shea
Supervisory Patent Examiner
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